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ABSTRACT

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A PRE-MATRICULATION PROGRAM FOR STUDENTS OF DENTISTRY

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ABSTRACT

A voluntary, pre-matriculation summer session for selected first-year dental students has been evolved to facilitate their development and academic progress. With dental students, practicing dentists, and dental school faculty as staff, the program focuses on basic science foundations, effective study skills, pre-clinical techniques,and professional role-models.

Students and program have been evaluated formatively and summatively through achievement tests, questionnaires, informal feedback sessions,and performance in the first-year curriculum. Results indicate that this program of cognitive, psychomotor,and affective activities provides enrichment for the participants and useful educational experience for the staff.

INTRODUCTION

The admissions committees of health professions schools recognize the importance of selecting qualified students whose academic backgrounds vary from those of traditional pre-professional candidates. The depth of basic science backgrounds, the extent of pre-professional education, interruptions in academic experience, and orientation to the professional school and its curriculum are among the factors that account for an increasing heterogeneity of students in these schools. To address the differential needs of individual students, many schools of dentistry have developed tutoring programs, individualization, and other services to facilitate academic progress. Too frequently, these efforts are remedial, occurring after students have performed poorly on examinations.

However, there is an increasing awareness of the need for programs designed to promote student development and intercede before problems surface. In accordance with this rationale, the School of Dentistry of Case Western Reserve University has offered to selected first-year students an enrichment program in cognitive, psychomotor, and affective areas prior to enrollment. For the past two summers (1973, 1974), seventeen students, including seven from minority groups, have participated voluntarily in a four-week pre-matriculation session. Participants have been invited to the program by the Admissions Committee of the School on the basis of identified presenting features. (The authors, who developed, directed, and evaluated the program, were not involved in the actual selection process).

PROGRAM OBJECTIVES

The program, as it evolved in the summer session of 1974 for seven participants, had the following objectives for students:

To Simulate the Extent and Depth of the Actual Dental School Schedule

The first two years in dental school present a rigorous schedule with 35-40 contact hours weekly. Among the curricular components are lectures, science laboratories, pre-clinical laboratories, seminars, and tests. The summer program introduced the schedule, and attempted to assist students in allocating time and resources. In this manner, students could experience the variety of large class exercises, small group sessions, and individualized instruction, typical of the educational offerings of the dental school curriculum.

To Enhance Concepts in Basic Science Areas Needed for Course Work in Dental School

For Case Western Reserve University dental students, the basic science curriculum includes anatomy, physiology, histology, and biochemistry in the first year, and microbiology, pathology, and pharmacology in the second year. A firm understanding of concepts in organic chemistry, cell biology, and physical science is a requisite for the entering student.

To Provide Samples of Actual Course Lectures From the First Year Dental Curriculum

Experience in a lecture environment of one hundred students is the major intent, rather than introduction of curricular content. Many students (especially those with academic backgrounds where small group instruction dominates) find it difficult to adjust to the tempo, quantity of information, and diversionary stimuli of such lectures. Introduction of faculty and their styles of instruction were also considerations.

To Identify Potential Problem Areas, and to Provide Individual Instruction

Several components of the program were designed to provide the students with realistic information about their strengths and weaknesses, to promote self-assessment and recognition of troublesome subjects, and to explore resources for assistance. The individualized instruction of the summer program was intended to link participants to available tutors, and to stimulate small group interactions with peers and upperclassmen. An additional gesture was the provision of teaching opportunities for the staff of upperclass students.

To Improve Study Skills Applicable to the Dental School Curriculum

For some students, study strategies successful in undergraduate school may be neither efficient nor effective in the learning environment of the dental school. To adjust individual learning styles to the demands of the subject matter, students were encouraged to explore alternative techniques for reading scientific material, for organizing information, and for synthesizing. Further, methods were introduced to help students integrate and retrieve knowledge from multiple sources, and to enhance test-taking skills.

To Provide Exposure to Performance of Pre-Clinical Dental Techniques

Psychomotor activities were designed to stimulate interest and provide an introduction to manual skills and dental materials. Involvement in laboratory technique sessions was intended to provide a mix of activities, as well as a change of pace from the intensive cognitive activities of the summer experience.

To Present Models of Professional Roles in Dentistry

To promote and reinforce professional identification and enthusiasm, professionals in dentistry were invited to describe their activities. It

was hoped that students from non-traditional backgrounds (i.e., students who did not participate in pre-dental programs, or those of non-basic science disciplines) might see the many dimensions of their chosen profession.

PROGRAM COMPONENTS

While the program offered a variety of activities, it was principally structured along three dimensions: cognitive, psychomotor, and affective.

Cognitive

The cognitive experiences included lectures covering topics from the physical and life sciences consistent with the dental basic science curriculum. Some lectures were given by faculty instructors. Others were provided by the program staff of upperclass students who developed and presented much of the content based upon their recent course experiences. The selection or emphasis on material was modified by assessment of student needs. Thus, many of the lectures dealt with topics identified as fundamental for future course work, recognized as being difficult conceptually by upperclassmen, or indicated from examinations as troublesome for individual students. Samples of actual course lectures were also presented for the purpose of demonstrating the pace and style of instructors, and as a gauge of content volume to be expected.

Since the school's dental curriculum is arranged departmentally, methods of integrating information from various subject areas (histology, physiology, pathology, etc.) were illustrated through a series of lectures on the structure and function of the kidney. Students were thus introduced to a systems approach of assimilating and relating separate departmental coverage of an organ.

Another cognitive feature was a series of workshops concentrating on the improvement of study skills. The activities of these workshops included:

assimilating information from texts and handouts, note-taking from lectures, integrating concepts from course notes, preparing for studying and test-taking, and aids to test-taking.

Assimilating information from texts and handouts. One aspect of these workshops familiarized students with elements of scientific and medical vocabulary (prefixes, roots, suffixes). The students were also encouraged to become active readers, to react to, analyze, and synthesize content rather than merely to take notes. A structure for reading, Francis Robinson's SQ3R approach (Survey, Question, Read, Recite, Review) was applied to textbook and journal assignments. Skills for versatility in reading were introduced which stressed the adjustment of purpose, rate, and style of reading to the type of material.

Note-taking from lectures. A practicum in note-taking methods emphasized flexibility and accuracy of student notes. Lectures were videotaped, students took notes, and completeness of notes was checked against examination questions prepared by the instructors. Further, selected aids to lecture content assimilation were examined, such as tape recording. Tips for efficient use along with certain cautions were pointed out.

Integration of material. In another workshop, students applied various processes of organization and synthesis to their notes to promote their retrieval in usable form. Techniques for centralizing notes (from lectures, texts, and other sources), identifying key concepts and organizing threads, and associating or contrasting topics were practiced. Students were encouraged to rework their notes by preparing possible test questions, developing diagrams and charts, and summarizing major concepts.

Preparedness for studying and test-taking. Group discussions aimed at understanding test anxiety and avoidance behaviors, focused on skills for psychological preparedness. Students explored techniques to stimulate efficient study by modifying environments, time schedules, and pace of study, and by providing self-study rewards. Tension-reducing aids, such as test-taking simulations, were also suggested.

Test-taking aids. Finally, a test-taking workshop explored a wide variety of skills to promote an active "dialogue" between student and examination. Students discussed the use of old tests, and were encouraged to read examinations carefully with special attention to directions and key words. They worked with program interim examinations in trying out approaches to multiple-choice questions, guessing strategies, and budgeting time. They also identified and became sensitive to grammatical clues, longest-alternative considerations, specific determiners, converse pairs, and question format differences as test-wiseness cues.

Individualized instruction. A final component of cognitive activities was individualized instruction sessions in which participants teamed with assigned staff members for tutoring. Upperclass staff members assisted students ascertain problem areas from test feedback, instruct with active student participation, and most important, carry through and apply skills from learning technique workshops. These sessions were organized either on a one-to-one basis or in groups of two or three.

Psychomotor

To provide beginning experiences with manual and perceptual skills, a laboratory series included both demonstrations and student participation.

Histology laboratory involved using microscopes, observing structures on various organizational levels (cell organelles, cells, tissues, organs and systems). Students also compared two and three-dimensional information from sources such as transmission and scanning electron microscopes, histological observation, Kodachrome micrograph slides and text diagrams. An anatomy laboratory introduced students to cadavers, skeletons and dissection, with emphasis on orientation to body positions, directions of movement, and anatomical terminology.

Dental materials laboratories offered an introduction to pre-clinical skills, materials, and equipment. The regular pre-clinical curriculum is organized into complete projects, such as the production of a crown and bridge analogue. However, the summer program provided experiences with component skills, including waxing, polishing, casting, denture processing, and impression-taking. These activities helped simulate the pre-clinical laboratories which comprise about one-third of the first two-year dental curriculum. They were woven into the fabric of the summer program schedule for variation and enjoyment, as well as for practical considerations.

Affective

Although specific attitudinal objectives were not delineated, certain activities had notable affective dimensions. The participation of dental practitioners in a seminar series, "Dentistry as a Profession," provided a variety of role models. Dentists and associated professionals involved in general practice, specialties, academia, administration, community health, and research contributed to the appreciation of the scope of dentistry for both participants and staff. Upperclass student instructors were not only figures for identification, but also sources of emotional and intellectual

support. These staff members familiarized participants with the physical facilities, provided first-hand experiences and anecdotes from their own education, and invited the students to observe clinical procedures in the concurrent summer clinic periods for third and fourth year students. Student-student interaction fostered camaraderie and new friendships which have been retained and strengthened through the school year. Finally, faculty instructors provided orientation to their first year courses, delineating objectives and interrelations among lectures, assignments, laboratories, and tests. Upperclass students participated in these informal sessions, producing an unusual interchange between faculty and former students concerning course offerings. Participants often credited these activities with promoting their self-confidence and communicative ability with students and faculty.

EVALUATION

Formative and summative assessments of staff, students, and the program were accomplished by means of achievement tests, projective measures, and questionnaires.

Pre- and Post-tests

A set of 150 cognitive items was developed by the staff, stratified into biochemistry, morphology, and physiology components, and assigned randomly to pre- and post-tests. The tests were administered on the first and final days of the summer program. All students scored higher on the post-test with an average increase of 15.3 percent. A one-tailed dependent-sample *t*-test indicated a highly significant increase in scores ($t = 3.5$ with $df=6$, $p<0.01$).

The identical pre-test was administered to the entire incoming class (N=102) on the first day of dental school (which occurred one week following the end of the summer program). The summer participants again scored significantly higher on this repeated measure ($t = 3.3$ with $df=6$, $p<0.01$). The reliability coefficient for the pre-test accumulated from class results was higher than for most dental school exams (Cronbach alpha = 0.66). Whereas six out of seven participants' scores initially would have placed them in the lowest quartile of the class, the actual average score on the repeated test for the seven participants was in the top quartile (70th percentile).

Interim Achievement Tests

During the program, weekly achievement tests and individual conferences provided feedback as to strengths and weaknesses. Students were informed of their total and subtest performance, both compared with the group of participants (the dental school grading is norm-referenced) and on an absolute percent scale. Given this analytical information in a non-threatening environment, the students revealed notable skills of self-assessment. Often participants could relate their performances to clearly identifiable variations in study habits, motivation, time availability, or non-academic distractions.

Projective Measures and Questionnaires

Initially, a projective measure of each student's achievement motivation was obtained. The results were discussed with the participants individually and confidentially, to enhance their self-awareness. Group results were assessed to provide approach techniques and tutoring tips for the staff.

Participants and staff appraised the effectiveness of lectures and presentations on feedback questionnaires. They rated interest, organization,

level of difficulty and time utilization. These evaluations were discontinued midway through the program as participants explained that completing so many questionnaires was time-consuming. Instead, an evaluation instrument was administered at the end of the program and again during the Spring 1975 semester, on which participants ranked program components, and rated the overall program according to the following criteria: value in preparation for dental school, interest of presentation, organization, and time apportionment.

Whereas cognitive and psychomotor components, notably lectures and laboratories, were considered most valuable immediately following the program, retrospective assessment emphasized the usefulness of individual instruction sessions, test-taking skills and experience, and affective components of the program.

The simulation of the extent and depth of the dental school schedule was consistently ranked valuable. Participants also cited positive influences of the program on their self-confidence, recognition of academic problem areas, and enthusiasm for their professional career choice.

Assessment of participants' expectations and attitudes about dental school and dentistry was determined by a questionnaire developed by the authors. Administered before and immediately following the program as well as during the Spring 1975 semester, this instrument will be used again at several points as the participants progress in dental school, thus generating longitudinal information. The students have been asked to rank study techniques and strategies, problem-solving approaches, descriptions of dentistry as a profession, and actual concerns or problem areas associated

with academic progress. Statistical analysis of these data are incomplete at this time; however, it appears that learning skills and communication with colleagues and faculty were promoted by the summer program. Through the program and the first academic semester, students became more realistic about their own performance levels and more appreciative of the difficulty and emphasis on examinations in dental school.

Student Performance and Parallel Group

Perhaps the most important evaluative measure for the program effectiveness is the performance of the students through the academic curriculum. While only the first semester achievement and second semester interim results are presently available, all participants are in good academic standing. Of seven courses in the first semester, only one participant was required to complete remedial work (in one course, oral biology, which was not addressed in program lectures). None of the participants failed any courses.

While it was impossible to select a true control group among other incoming students (all students for whom the program was thought to be helpful were invited) a parallel group of seven students was selected for comparison purposes. Two students in the parallel group were invited but were unable to attend the summer program, and the additional five students were selected on the basis of similar performance on objective undergraduate grade-point average and science average, Dental Admission Test scores, and program pre-test scores. While all categories of compared criteria were higher for the parallel group, the differences in undergraduate averages were not significant.

In the first semester performance, the program participants achieved a higher mean dental school grade-point average (71.4 vs. 67.6 for the parallel

group, based on a course mean of 80 with a standard deviation of 10 for the class of 102). While the difference is not significant ($p>0.05$), the results indicate satisfactory performance by the summer participants with no unfair advantage because of the program experience.

DISCUSSION

It should be noted that identifiable problems arose. The complexity of planning and logistics was considerable. The voluntary nature of the program and the timing during summer vacation affected the level of commitment in some instances. Success in the learning-technique workshops was influenced by individual willingness to acknowledge the need for such activities.

The program also resulted in benefits to staff, and to the regular dental curriculum. Upperclass students gained group and individual instructional experience. It has become apparent that specific features of the pre-matriculation program could be incorporated into the regular dental curriculum. A library resources component of the 1973 pilot program has already been placed within the biostatistics course for first-year students, and several approaches concerning learning techniques, developed in the summer program, have become part of the student affairs programs for matriculating students. Finally, the involvement of faculty from disciplines outside the School of Dentistry was beneficial to the program and fostered new and stimulating interactions.

The pre-matriculation program has been successfully implemented for two summers. The structured yet flexible format promoted interest and active participation of students and staff. Student progress indicates that their basic science concepts and learning skills have been strengthened. In addition, participants reported that the program has given them a more

realistic appreciation of dental school and a more confident outlook. Intervention and skill development prior to matriculation have been demonstrated to be influential in academic success for these participants.